

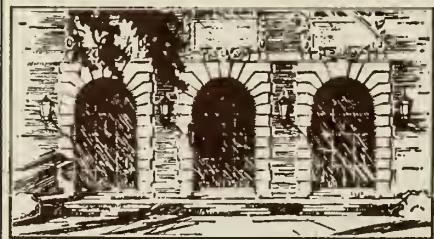
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UNIVERSITY OF ILLINOIS
GRADUATE COLLEGE
DIGITAL COMPUTER LABORATORY

REPORT NO. 112

A REPORT ON A SPECIAL SUMMER COMPUTER PROGRAM
FOR UNDERGRADUATES

by

L. D. Fosdick

October 9, 1961

SUMMARY

This is a report on a summer undergraduate program held at the Digital Computer Laboratory during the summer of 1961, and supported by the National Science Foundation. The aim of this program was to interest outstanding undergraduates in computing and in pursuing graduate studies in this field.

The ten undergraduates, from ten Universities in the United States and Canada, who participated in this program attended seminars on programming, numerical analysis, and computer design. They used the Illiac extensively and worked on individual projects in computing.

A recommendation is made here to repeat this program in the summer of 1962 and suggestions are made for its improvement.



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Introduction

This report is a description of a special summer program on the use and construction of stored-program computers conducted by the Digital Computer Laboratory of the University of Illinois during the eight week period commencing June 19, 1961 and terminating August 11, 1961. The number of participants in this program was limited to ten undergraduates from colleges in the United States and Canada who had completed the sophomore or junior year, but had not completed the senior year. This program was under the supervision of Professor L. D. Fosdick of the Digital Computer Laboratory assisted by Professor G. H. Leichner of the Electrical Engineering department and Professor H. S. Wilf of the Mathematics department. Financial support for this program came from the National Science Foundation.

The object of this program was to generate an appreciation for and an interest in doing graduate work in the field of computers and computing among undergraduates. Furthermore, since it was hoped that we might draw some of our own future graduate students from the participants, this program gave us the opportunity to judge their abilities by direct contact.

Selection of Participants

The first step in obtaining participants was to advertise the program. This was done by mailing a form letter to the chairmen of departments of mathematics at a number of schools which asked for nominations and with which was enclosed a brochure describing our laboratory and a poster announcing the summer program.

Attachment I to this report contains the list of schools contacted, a copy of the form letter and a copy of the poster sent.

This advertisement generated a number of requests for application forms which were then mailed, filled out, and returned to us. In addition to the completed application form at least three letters of recommendation and a transcript of grades were requested. A sample application form is included as Attachment II to this report. We received sixty-one completed applications.

From these sixty-one applications a committee of three, Professors A. H. Taub, L. D. Fosdick and G. H. Leichner, selected and ranked into three groups fifteen of these applicants. The basis for this selection and ranking consisted of the grades shown in the transcript, the letters of recommendation, and the statement written by the applicant on the application form. Previous computing experience by the applicant was not a factor in this selection.

Of the fifteen thus selected, the people in the top two groups of five were informed by letter on March 1 that they had been chosen as participants in our program. They were asked to indicate their acceptance by March 15, 1961. The five people in the other group were informed that they were alternates and the remaining applicants were told that they had not been accepted. All of the ten people chosen as participants accepted, so the alternates were then informed that they could not be accepted. A list of the names of the ten participants and their schools is given in Attachment III to this report.

Program

The program consisted in part of regularly scheduled seminars. One series of seminars, led by Fosdick, was devoted to programming and related topics, another series of seminars, led by Wilf, was devoted to numerical analysis, and the third series of seminars, led by Leichner, was devoted to computer construction and related topics.

These seminars were supplemented by occasional seminars by invited speakers. These supplementary seminars were designed to cover the various areas of research in our laboratory; several of these seminars were devoted to the new Illiac. In addition one talk was given by Professor P. Braunfeld of the Coordinated Science Laboratory on the teaching machine project, and several members of the mathematics department spoke on special topics in mathematics.

The regular seminars on programming met intensively for the first few weeks and they were devoted to details of programming the Illiac; these seminars met Monday thru Friday for about two hours each day. After this,

meetings were held Monday thru Friday for one hour periods and during the last week the seminars met on alternate days for one hour. Aside from the topics on Illiac programming, the other topics covered included, flow diagrams, assemblers and compilers, errors, scaling problems, approximations for special functions, random numbers, Monte Carlo computations, merging and sorting, and table look-up procedures.

The topics covered in the seminar on numerical analysis included numerical solution of differential equations, Picard's theorem for differential equations, matrices and linear operators, eigenvalues, inverses, numerical calculation of eigenvalues and inverses, orthogonal polynomials and Gauss gradrature.

The seminars on computer construction met two days a week, each meeting lasting two hours. The topics covered included Boolean algebra in logical circuits, logical building block circuits, use of reduction techniques for circuit simplification, computer building blocks, typical computer structure, mechanization of arithmetic, trouble shooting techniques and analog computers.

Each participant was given a project to work on, some of these projects being individually done and others were done as a team effort. Five people worked on projects supervised by Fosdick and the other five worked on projects supervised by Wilf. A listing of these projects follows.

Two people (Minkin and Lane) were engaged in writing model programs for doing numerical integrations. These programs were to be written in a form suitable for use as models in programming courses Math 295 or Math 395. One person (Gibbard) was engaged in developing a fast generator for random normal deviates and a testing routine for this generator, he also worked on a simple geometry problem. Another (Dubuc) wrote four programs for computing elliptic integrals by various schemes. He also did a little work on a Monte Carlo problem. One other (Price) worked on a program to plot lines of force for two point charges, he also did some work on a simple geometry problem. A team of two people (Read and Merrow) worked on a problem in number theory, trying to find counterexamples to a conjecture by Riemann concerning the zeros of the Riemann zeta function. Another team, consisting of three people (Horn, Miller

and Shapiro) numerically tested a conjecture by G. Polya and J. Schoenberg concerning convex conformal maps of the unit circle. No counterexamples were found, increasing the strength of this conjecture. Wilf's comments on this work will be found in his report which is Attachment IV to this report.

Observations and Recommendations

The following list summarizes our recommendations for this program:

- a) The program should be repeated next summer;
- b) The topics covered and format of presentation should remain the same, with minor exceptions cited below;
- c) The number of participants (ten) and regular seminar leaders (three) should remain the same;
- d) Initial advertisement of the program should be increased to contact more people;
- e) Administrative procedures should be simplified;
- f) The method of payment of stipend should be changed.

Comments on these recommendations, in the order listed, follow.

The participants were asked to write to us and state their observations and recommendations about the program; the letters which have been received are included as Attachment V to this report. On the basis of these letters and personal conversations with the participants it is felt that they thought the program to be very worthwhile, and that it should be repeated. One of them (Price) has already stated that he wants to go on to graduate work in this field at the University of Illinois. It is of course too early to really determine whether the program met the objectives cited earlier, but the information now available clearly indicates that it would be worthwhile to repeat this program in the summer of 1962.

It seems that the present arrangement of three regularly scheduled seminars on programming, numerical analysis, machine construction and design is satisfactory and should be continued. Because the background of the participants is varied the specific content of these seminars should be somewhat flexible so that it can be moulded to fit the needs of the group. Although the slower people may suffer a little, the aim should be to help the brightest people interested. There is a special difficulty connected with instruction in programming the Illiac. The use of the Illiac is a fundamental part of the program and it should be taught as quickly as possible. Some of the participants may have experience with other computing equipment and others may have no such experience. In this case, there should be an intensive set of talks given to the inexperienced people on how to program the Illiac. The experienced people need not attend these talks since they can probably spend their time more effectively by reading the "Guide to Illiac Programming" on their own.

The seminars on programming, which were led by the author of this report, lacked a strong interchange of questions and answers between participants and speaker. An effort should be made to increase these interchanges, however it is not felt that it would be wise to have special talks led by the participants themselves, except in unusual circumstances. Such talks are too often a waste of time for everybody except the speaker. The assignment of short homework problems and discussion of these problems is recommended as a means for stimulating questions and answers.

A small number of participants is highly recommended. There does not seem to be any reason for changing the present number of ten participants. The present arrangement of having three people to lead the three regular seminars is highly satisfactory and definitely should be continued.

It is recommended that the advertisement of the summer program include an announcement in the journal "Communications of the Association for Computing Machinery". Furthermore each announcement sent to a University should include a few sets of application forms. The application forms should request the same information as the regular form for undergraduate admission to the University, in addition to letters of recommendation. This will

reduce the amount of later correspondence. These announcements should be mailed no later than November 1.

Arrangements should be made as early as possible (before November 1) with the Dean of the Summer School for handling the summer program. It is suggested that a meeting be held between the Dean of the Summer School and other interested University personnel and representatives from the Digital Computer Laboratory to discuss these arrangements.

It is recommended that the stipend of \$400 be paid in a lump sum on arrival of the participant. Actually, of the \$400, only the remaining part after deduction of housing fees (which for the current summer amounted to \$200) would be paid in cash to the participant. This would ease the initial financial burden on the participant and eliminate the work associated with having the stipend paid in two installments.

ATTACHMENT I

LIST OF SCHOOLS CONTACTED

FORM LETTER

POSTER

LIST OF SCHOOLS CONTACTED

<u>Institution</u>	<u>Location</u>
Amherst College, Antioch College, University of Arizona, University of Arkansas, Bates College, Bowdoin College, Brandeis University, Brown University, California Institute of Technology, University of California,	Amherst, Massachusetts Yellow Springs, Ohio Tucson, Arizona Fayetteville, Arkansas Lewiston, Maine Brunswick, Maine Waltham 54, Massachusetts Providence 12, Rhode Island Pasadena 4, California Berkeley 4, California
University of California, University of California, University of California, University of California, Carleton College, Carnegie Institute of Technology, Case Institute of Technology, University of Chicago, University of Cincinnati, City College,	Davis, California La Jolla, California Los Angeles 24, California Santa Barbara, California Northfield, Minnesota Pittsburgh 13, Pennsylvania Cleveland, Ohio Chicago 37, Illinois Cincinnati 21, Ohio New York 31, New York
Clark University, Colby College, Colgate University, University of Colorado, Columbia University, Cornell College, Cornell University, Dartmouth College, University of Delaware, De Pauw University,	Worcester, Massachusetts Waterville, Maine Hamilton, New York Boulder, Colorado New York 27, New York Mount Vernon, Iowa Ithaca, New York Hanover, New Hampshire Newark, Delaware Greencastle, Indiana
Drake University, Duke University, Earlham College, Florida State University, University of Florida, George Washington University, Georgetown University, University of Georgia, Grinnell College, Hamilton College,	Des Moines 11, Iowa Durham, North Carolina Richmond, Indiana Tallahassee, Florida Gainesville, Florida Washington 6, D.C. Washington 7, D.C. Athens, Georgia Grinnell, Iowa Clinton, New York

<u>Institution</u>	<u>Location</u>
Harvard University, Haverford College, Hunter College, Illinois Institute of Technology, University of Illinois, Indiana University, Iowa State University, State University of Iowa, John Hopkins University, University of Kansas,	Cambridge 38, Massachusetts Haverford, Pennsylvania New York 21, New York Chicago 16, Illinois Urbana, Illinois Bloomington, Indiana Ames, Iowa Iowa City, Iowa Baltimore 18, Maryland Lawrence, Kansas
University of Kentucky, Kenyon College, Knox College, Lehigh University, Louisiana State University, McGill University, University of Maine, University of Manitoba, Marquette University, University of Maryland,	Lexington, Kentucky Gambier, Ohio Galesburg, Illinois Bethlehem, Pennsylvania Baton Rouge, Louisiana Montreal 2, Quebec Orono, Maine Winnipeg, Manitoba Milwaukee 3, Wisconsin College Park, Maryland
Massachusetts Institute of Technology, Miami University, Michigan State University, University of Michigan, Millikin University, University of Minnesota, University of Minnesota Inst. of Tech., University of Montreal, University of Nebraska, University of New Mexico,	Cambridge 39, Massachusetts Oxford, Ohio East Lansing, Michigan Ann Arbor, Michigan Decatur, Illinois Minneapolis 14, Minnesota Minneapolis 14, Minnesota Montreal, Quebec Lincoln 2, Nebraska Albuquerque, New Mexico
New York University Washington Square College, University Heights Campus, University of North Carolina, Northwestern University, University of Notre Dame, Oberlin College, Ohio State University, University of Oklahoma, University of Oregon,	New York 3, New York New York 53, New York Chapel Hill, North Carolina Evanston, Illinois Notre Dame, Indiana Oberlin, Ohio Columbus, Ohio Norman, Oklahoma Eugene, Oregon
University of Pennsylvania, University of Pittsburgh, Princeton University, Purdue University, Queens College,	Philadelphia 4, Pennsylvania Pittsburgh 13, Pennsylvania Princeton, New Jersey Lafayette, Indiana Flushing 67, New York

<u>Institution</u>	<u>Location</u>
Radcliffe College,	Cambridge 38, Massachusetts
Reed College,	Portland 2, Oregon
University of Rochester,	Rochester 3, New York
Roosevelt University,	Chicago 5, Illinois
Rutgers University College,	New Brunswick, New Jersey
Smith College,	Northampton, Massachusetts
Stanford University,	Stanford, California
Swarthmore College,	Swarthmore, Pennsylvania
University of Texas,	Austin 12, Texas
University of Toronto,	Toronto, Ontario
University of Utah,	Salt Lake City 1, Utah
Vanderbilt University,	Nashville 5, Tennessee
Vassar College,	Poughkeepsie, New York
Washington State University,	Pullman, Washington
Washington University,	St. Louis 30, Missouri
University of Washington,	Seattle 5, Washington
Wayne State University,	Detroit 2, Michigan
Whitman College,	Walla Walla, Washington
Williams College,	Williamstown, Massachusetts
University of Wisconsin,	Madison 6, Wisconsin
Worcester Polytechnic Institute,	Worcester 2, Massachusetts
Yale University,	New Haven, Connecticut

UNIVERSITY OF ILLINOIS
DIGITAL COMPUTER LABORATORY
URBANA, ILLINOIS

I am writing to ask you to nominate undergraduate students who would be interested in being considered for the program described in the enclosed announcement. We plan to take at most ten students and therefore suggest that you recommend that only very promising students apply. Previous experience with digital computers is not required. We shall give preference to those students who are considering going on to graduate school. We do not expect any applicant to promise to go on to graduate study at the University of Illinois or elsewhere.

Our purpose in starting this program is to stimulate interest in the study of the design and use of computers among future graduate students. We feel that this purpose will be met if a group of promising young people who are likely to go on to do graduate work are brought together for eight weeks and subjected to a training and working program.

The enclosed brochure may be of interest to you and some of the students you may consider for nomination.

Thank you for your trouble.

Sincerely yours,

A. H. Taub
Acting Head

AET/hc
Encls.: Brochures,
Posters

UNIVERSITY OF ILLINOIS
DIGITAL COMPUTER LABORATORY
URBANA, ILLINOIS

DIGITAL COMPUTING

for Promising Undergraduates

Beginning June 19, 1961, the Digital Computer Laboratory of the University of Illinois will conduct an eight-week undergraduate training and working program, concerned with the use and construction of computers, for a limited number of advanced undergraduates.

Students in residence at any college or university in the United States or Canada who will be juniors or seniors in the fall of 1961 and who are interested in learning about and working with stored-program digital computers are invited to apply for admission.

Successful applicants will receive a stipend of \$400.00 and travel expenses to and from Urbana, Illinois.

No academic credit will be given to students engaged in this program.

Application forms may be obtained by writing to Professor L. D. Fosdick, Digital Computer Laboratory, University of Illinois, Urbana, Illinois.

The closing date for receiving applications is February 1, 1961.

Appointments will be announced by March 1, 1961.

ATTACHMENT II

UNIVERSITY OF ILLINOIS

DIGITAL COMPUTER LABORATORY

APPLICATION FOR UNDERGRADUATE SUMMER STUDY PROGRAM

Mr.

(Major field of study)

Miss

Mrs.

NAME IN FULL
(do not use initials)

Mailing Address

(Street)

(City)

(State)

Home Address

(Street)

(City)

(State)

Place of birth

Date of birth

Country of which you are a citizen

Marital status

Number of children

Other dependents

Physical defects, if any

ACADEMIC TRAINING: (Give names of all junior colleges, colleges, universities, graduate, and professional schools at which credit has been earned.)

Institution and Dates Attended

Major and Minor Fields

Degree and Date

EXPERIENCE: (Teaching, research, professional, business, military, etc. Account for all of your time since the beginning of your undergraduate work up to the present other than time spent in academic training.)

Institution or Organization

Dates

Nature of Work

MEMBERSHIP IN HONOR SOCIETIES AND IN
LEARNED AND PROFESSIONAL ORGANIZATIONS:SCHOLARSHIPS, PRIZES, HONORS, OR OTHER
RECOGNITION:

FOREIGN LANGUAGES:

What languages other than English do you speak? _____

Read? -

Recommendations. Four recommendation forms are enclosed. These should be given to persons who are well acquainted with your educational background, intellectual abilities, and personal character. List the names and addresses of those to whom you have given the recommendation forms. *An application will not be considered unless there are at least three recommendations on file by the deadline date.*

Insert below a statement of not more than three hundred words concerning your past work in your proposed or allied fields of study, including non-course educational experiences, teaching or other relevant employment, publications, and your plans for graduate study and a professional career.

ARE YOU RELATED, BY BLOOD OR MARRIAGE, TO ANY MEMBER OF THE BOARD OF TRUSTEES, FACULTY
OR STAFF OF THE UNIVERSITY OF ILLINOIS? _____ If so, indicate relationship _____

have read the instructions for filing an application and I certify that the above statements are correct and complete.

SIGNATURE

DATE

ATTACHMENT III

LIST OF PARTICIPANTS IN THE SUMMER PROGRAM

<u>Name</u>	<u>Institution</u>
Dubuc, Serge	University of Montreal
Gibbard, Allan F.	Swarthmore College
Horn, Roger A.	Cornell University
Lane, Miss Lorinne	University of Illinois (Urbana)
Merrow, Charles M.	Whitman College (Washington State)
Miller, Jr., Forrest R.	University of Oklahoma
Minkin, Miss Anne S.	Georgia Institute of Technology
Price, Thomas R.	Earlham College
Read, Thomas T.	Oberlin College
Shapiro, Gerald	Massachusetts Institute of Technology

REPORT ON ACTIVITIES SUPPORTED BY THE NATIONAL SCIENCE FOUNDATION

Herbert S. Wilf

With the aid of the Foundation's support and of affiliation with the Digital Computer Laboratory of the University, I was able to engage in essentially two kinds of activity: the first concerned the teaching of a course in numerical methods and applied mathematics to a group of NSF summer fellows from various undergraduate schools, and the second involved carrying out some mathematical research on the computing facilities of the Laboratory. These two activities were closely related since the machine research was in part a vehicle for teaching the use of computers to the students.

The topics covered in the seminar on numerical analysis included numerical solution of differential equations, Picard's theorem for differential equations, matrices and linear operations, eigenvalues, inverses, numerical calculation of eigenvalues and inverses, orthogonal polynomials and Gauss quadrature. I would say that the level of comprehension was quite high, in general, as was evidenced by good questions and solutions to assigned problems.

Of the two problems assigned on the computer for research, the first concerned a hunt for counterexamples to a conjecture put forth by Polya and Schoenberg in 1957 (Pac. J. Math.). This conjecture is quite important in conformal mapping theory and had never been either proved or numerically tested. As a result of a quite extraordinary programming effort by three of the summer students (Messrs. Horn, Shapiro and Miller) the program was completed in mid-August and run quite extensively on the computer. No counterexample was found but the effort must be counted a fine success anyway since the plausibility of the conjecture was greatly enhanced by the search. Professor Schoenberg has asked me to submit a summary of the calculation to MTAC, and this will be done presently.

The second problem, which was executed jointly by Messrs. Merrow and Read, involved carrying out a Gauss quadrature on the Riemann zeta function. This was considerably more straightforward than the calculation mentioned above. Some of the results of this calculation will appear in a note being prepared for MTAC by Mr. Read.

Finally, in order better to acquaint the visiting students with the staff and work at the University, I arranged a series of three one hour talks which were given on successive Wednesdays in August. Professor Heller spoke on some problems in topology, Professor Bateman spoke on the distribution of prime numbers, and Professor Day on fixed-point theorems and applications.

I should like to express my gratitude to the Foundation and to the Computer Laboratory for their support and affiliation, respectively. I feel that the summer's work was quite rewarding both for myself and for the students involved.

ATTACHMENT V

LETTERS FROM PARTICIPANTS IN THE SUMMER PROGRAM

C
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1064 W. La Deney Dr.
Ontario, California
August 19, 1961

Professor Lloyd Fosdick
Digital Computer Laboratory
University of Illinois
Urbana, Illinois

Dear Dr. Fosdick:

Enclosed is my travel voucher for the return trip. As I told you earlier, I did not come directly home, but stopped off for a few days in the Northwest. I put down the same number of meals as I had on the trip back there; and the distance to Pendleton, which is the roomette receipt enclosed, is less than to Ontario. I hope that this will be acceptable as I have it filled out.

I can't really offer any criticisms or suggestions on the way the program was conducted this summer without first stating that I thought the three of you directly concerned with the lectures and discussions did what I considered to be an excellent job, and totally acceptable in the same form for next year in my estimation. However, I would recommend considering the following changes for future programs of this type:

1. Spend more time in the lecture periods the first two weeks going over the specific information and techniques for programming the ILLIAC, so that programming and projects might be begun earlier.
2. Try to discuss in more detail, and earlier, the special uses of ILLIAC, such as library routines, data plotter or CRT, and using the drum. Included in this might even be a period or two spent on programming methods for the IBM 650.
3. Prior to the start of the program, send out more information regarding the University, for example, a map of the campus, regulations concerning bicycles, automobiles, dormitories, and registration (if this latter cannot be eliminated).
4. If possible, schedule a special code-checking and "short production" time for the group, say from 11 to 12 in the morning, similar to what was the procedure on the 12:30 code checks during the last week we were there.

Thank you for a most rewarding summer's work. I don't believe I have ever learned so much in so short a time, or in such an interesting and enjoyable manner. I shall look forward to seeing you again sometime, perhaps in the fall of '62!

Respectfully yours,
/s/ Charles Merrow
Charles Merrow

C
O
P
Y

Route 2
Princeton, Illinois
September 3, 1961

Professor Taub
Digital Computer Laboratory
Urbana, Illinois

Dear Professor Taub:

In regard to the summer computing course, I definitely feel it should be repeated next summer if at all possible. I feel I benefited quite a bit from it. In my case, I found it especially helpful. I had been considering a career in programming, and this gave me a very good opportunity to find out if I was really going to enjoy the field. From my experience this summer I am convinced that I do want to go into programming.

You also asked us to give any comments or criticisms on how the program was run. I think it would have been better to hold all classes in the morning. This would have given us a longer uninterrupted period to work on our individual projects. Having an afternoon class starting at 1:30 p.m. cut into the afternoon. There was really not time enough to get anything accomplished before the class started, and afterward there was scarcely time to prepare for a four o'clock code check.

I also think some of the time devoted to guest lecturers could have been more profitably spent. Either the talks should be more worthwhile or the lectures should be dropped from the program. If they are to continue, I would suggest that the series be more coordinated. Several of the lectures covered much the same material. Other lecturers didn't seem to be well prepared. I think it would be more helpful and informative if a lecture covered a restricted area and then gave us some detail in that area.

I realize that some in the group had had previous experience, but for those of us who hadn't, it was a little difficult at times when someone told us that at this point we should perform a certain operation but never actually told us how to do it.

I think classes could have been more concentrated at the beginning before we had become familiar with the material. It would have been helpful also to write a simple program or two before we plunged into more difficult problems.

On the whole, however, I was well satisfied with the program and strongly recommend that it be repeated next summer.

Sincerely yours,
/s/ Lorinne Lane
Lorinne Lane

C
O
P
Y

September 4, 1961

Dr. L. D. Fosdick
Digital Computer Laboratory
University of Illinois
Urbana, Illinois

Dear Dr. Fosdick:

Let me say first of all that the eight weeks I spent in Urbana-Champaign were profitable and enjoyable. I was satisfied with the organization of the program and I would encourage a similar schedule when and if you offer such a program again. I will list my suggestions and opinions in three groups corresponding to our three classes.

The meetings with yourself had too much of an initial lag. I believe that almost everyone of us was well ahead of your discussions concerning the reading of the programming manual and the studying of the instruction codes. I think that you should cover this more rapidly and depend on questions from the members of the group to clear up anything that is not understood. The introduction to the logic involved in programming was presented satisfactorily, I thought, as this included the scaling problem and, in our case, the idiosyncrasies of a computer using 2's complement arithmetic. After this introduction experience is the best teacher and the classes should be devoted to methods, applications, and other topics of interest, as they were. I found particularly interesting - the use of Tchebyshev polynomials in telescoping a series, some of the talks concerning the new computer, Dr. Taub's talk on round off error, and the discussion of analyzing bubble chamber tracks. I would suggest, however, that the class meet only three times a week after the first two weeks. As I mention below I could have well spent the two afternoons studying the Ledley engineering book. Our meetings didn't reach as informal a state as they might have. I don't believe that any of us left any great mysteries float by without making inquiry but on the other hand we seldom had much participation in any discussions. The following might help to generate a different group attitude in class. If the group is nearly the same size (which I think is desirable) you could encourage some members of the group to give a report on a topic of interest (ill-conditioned polynomials, random number generators, particular physical and economical simulations, etc, etc, etc) based upon papers appearing in mathematical and computational journals, conference publications, etc. Many of these articles are within the knowledge and understanding of some of the members of our group. This need not be a binding requirement for you probably would not wish to have ten such reports made anyway.

I was glad that the study of logic design and the engineering problems of construction and operation was a part of the program. I did not, however, find sufficient time outside of class to spend on this course, as I spent most of my time studying and complementing the material Dr. Wilf was giving us. Of course

it is a matter of personal preference as to whether I should devote my time to math or engineering. The point is that I consider the math necessary and the engineering of interest but could not devote sufficient time to both. What I learned in this class was enough to justify its existence but I did not feel that we went into enough detail in anything we studied. For example we could have designed a small computer completely or have studied circuitry in more detail. I say this in retrospect as we didn't seem to be able to indicate to Dr. Leichner what we preferred or what we did or didn't know. Much of this was our own fault for many of us had the attitude ' I am busy working on our (my) project and studying the math. It will be interesting to go and listen but let Dr. Leichner do most of the work.' I think Ledley's book should be used more in class as a text book and as much of it, concerning design and engineering, covered as possible. If more could be covered in class the amount of time that should be spent on this course out of class would decrease. This together with the reduction of meetings mentioned in the above paragraph does not make the class reports which were suggested inconsistent with the amount of time available.

I was very pleased with Dr. Wilf's class on mathematical methods and I consider it to be a very important and necessary part of the program.

I thank you sincerely for the interesting eight weeks you arranged for us and for the patience you showed in bearing the weight of our demands and complaints (the travel expense sheets and the case of the locked supply cabinet for examples). It was apparent that you spent quite a bit of time in organizing the entire program and in planning the individual classes. Also we were very appreciative of the fine cooperation Mr. Huffman and Mr. Greenwood gave us.

Enclosed you will find my travel expense statement for the trip to Norman.

I am certainly interested in hearing of your future plans concerning such a program.

Very truly yours,
/s/ Forrest R. Miller, Jr.
Forrest R. Miller, Jr.
730 DeBarr St.
Norman, Oklahoma

C
O
P
Y

Box 839
Earlham College
Richmond, Indiana
September 14, 1961

Digital Computer Laboratory
University of Illinois
Urbana, Illinois

Dear Professor Fosdick:

The month that has passed since our NSF computer seminars closed has been filled with such things as moving from Dayton to Indianapolis, daily swimming, and in the last two weeks, the writing of a sixty-page report on digital computers for the physics department at my college (Earlham).

Unfortunately all this activity has not allowed me much time to write the evaluation which you requested we write at the end of our sessions. I hope that the informal paragraphs that follow will help you in making your decision about sponsoring a similar project next year.

The program which the U. of I. and the NSF jointly sponsored this summer gave me the opportunity to study and learn about a field that has held my interest since high school. This summer was my first real contact with digital computers. The books I had read on computers served only as introductions to the material that was presented during the summer.

Professor Wilf's course was difficult for me to apply. I was able to follow (most of) the lectures and work some of the example problems. But how to apply the theorems to actual computer problems is still not obvious to me. I have advanced calculus and differential equations this year. Perhaps after these two courses, I will be in a better position to apply what I learned.

I enjoyed Professor Leichner's course. At times he was bothered by the fact that there were no questions from the group. I asked more than my share, I feel. A majority of the group were majoring in mathematics and perhaps had not had enough electronics to understand what was presented.

During the last two weeks Prof. Leichner helped me in designing a binary adding circuit which I plan to construct during this school year. Earlham does not have an E.E. department, nor does it have anyone with Prof. Leichner's knowledge of electronics and digital circuitry. I found the time spent with Prof. Leichner to be very worthwhile.

If it were not for your book and programming sessions in the afternoon, Professor Fosdick, we would have all been lost! You were very clear in your explanations and descriptions. The problems that you gave the group were varied enough to suit the interests of our diversified group. Looking back,

now, I think I would have learned more quickly about programming and blunders if I had been given a simple problem involving one or two of the orders at a time instead of the one more difficult problem that used all orders.

For me, the summer was very beneficial. I have decided on the university at which I wish to do my graduate work, and the door through which I wish to enter the field of computers. The two decisions are: The University of Illinois, and physics.

I hope that you will decide to again sponsor a summer program in computers, and thereby provide ten or more college students with the same opportunity, experience, and background that I received this summer.

Before we left, those of us who did not get to the business office on Friday sent or left notes with our final reports giving our addresses and explaining that we were not able to pick up our \$100 checks.

I have not yet received my \$100 check. Would you please conduct a shakedown of the window #19 department in my stead.

Yours truly,
/s/ Tom Price
Tom Price
Math 001

P.S. I would be proud to have you read my report on computers, if you have time.

C
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P
Y

Swarthmore College
Swarthmore, Pa.
Sept. 25, 1961

Dear Mr. Taub,

Please excuse me for postponing so long the letter of evaluation which you requested.

I consider my eight weeks at the University of Illinois to be of very great value. I of course derived satisfaction from hard work in a fascinating field. At the same time I was impressed by the caliber and dedication of the nine students who worked with me. But the thing that gave the eight weeks their peculiar excitement and usefulness was our ample opportunity to use the Illiac, for such a course without actual experience would have taught very little.

It should be recognized that an eight week program cannot give a balanced view of computers and still be concentrated enough to be of value. In our case we concentrated on programming and spent little time out of class on design, or in my case at least on numerical analysis. The nature of the summer would, however, have been entirely different without these two courses and talks on the new computer, for while we did not gain a thorough knowledge of the field of computing as a whole, we did indeed get some idea of what is involved.

I have one minor criticism: the class in programming lagged so far behind our knowledge that at times it became ridiculous. Students in a concentrated program such as ours can be expected to get through the program manual in the first week.

Although my life work, while it will probably involve computers, will in all likelihood not be centered on them, and for this reason I would not be eligible to return next year, much as I would like to, I hope the program will be continued. The existence of high speed computers, it seems to me, will have significant effects on mathematics and physics, so that the knowledge and experience I gained last summer is likely to prove quite valuable for me in my later work.

Yours sincerely,
/s/ Allan F. Gibbard
Allan F. Gibbard

C
O
P
Y

312 Highland Road
Ithaca, New York
October 5, 1961

Professor L. D. Fosdick
Digital Computer Laboratory
Romine at Stoughton Street
The University of Illinois
Urbana, Illinois

Dear Professor Fosdick:

This afternoon I received the tape and print-out of my problem, and it seems that everything ran as it was supposed to. Thank you very much for your attention to my problem; I am gratified to have it come to successful fruition, and I am sure that Professor Bateman will be very pleased to have the results.

Unfortunately, I, too, have been quite busy with the beginning of a new term, and have delayed unforgiveably in telling you of my reactions to the program this summer. I act now, however, and let me say first and foremost that so far as I am concerned, the program was an unqualified success. The things I saw and learned were completely new to me, and the whole of my projected ambition has been markedly altered by my experiences this summer. Any further comments below are to be considered small points; I am very grateful to have had the opportunity to participate.

For me, the most significant part of the program was my project, and the generous allocation of already cramped computer time was a large factor in it being so. Unfortunately, I became so wrapped up in project work that my good intentions to learn about the IBM 650 came to naught; as I look back now I wish I had been encouraged to learn to program for it.

Of course, the significance of the project is a very personal thing, and the gain is almost solely a function of input. I think that an extensive list of significant projects prepared beforehand would be of great help to those students who are indecisive about their project work, and might help to indicate in a very clear way just what remains to be done.

I have spoken so far only of the project work, but the "formal" instruction is also a valuable part of the program. I felt (perhaps my major interest leaves my opinion not unbiased) that the series of lectures delivered by Professor Wilf were excellently developed, pitched at about the proper level, and exceedingly germane to the endeavors of the group. I often felt that the Programming and Logical Design sessions were pitched too low for the group's ability; a great deal more could have been done in this time if the content had been more challenging. I am inclined to feel

that these sessions would serve a better purpose if they were conducted on as high a level as people could stand, and allow people to attend only those in which they are interested. In fact, a seminar-type format might work out well.

But in fact, these are subsidiary things. The single thing which should be continued and even extended if possible is the availability of generous amounts of computer time, with adequate supervision, of course. This alone will enable the ambitious student to get the maximum amount of experience and benefit from the program.

I hope, sir, that my few ideas may prove helpful in your planning for next year; I am very much interested in hearing about next summer's program and would be glad to spread the word here when you come up with final plans.

Again, let me say how very much I appreciated your efforts and those of the staff. This summer I had a chance to do some of the most significant things I have ever done, and I thank you for making it possible.

Sincerely yours,
/s/ Roger A. Horn
Roger A. Horn



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